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ABSTRACT

This document provides a suggested timetable for implementation of the metric system in all schools in New York State. The timeline extends from January 1976 through 1980 and is divided into five phases. These phases are defined by educational goals: (1) awareness, (2) knowledge, (3) comprehension, (4) application, and (5) commitment. Suggestions for the phases (especially phase 4) are offered, and guidelines for selecting materials and teaching the metric system in elementary and secondary schools are set forth. Suggestions for secondary school metric activities include uses of the system in 15 curricular areas. A few activities are provided. (SD)

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THE METRIC SYSTEM

IDEAS FOR INTRODUCING THE METRIC SYSTEM

U S DEPARTMENT OF HEALTH,
EDUCATION & WELFARE
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EDUCATION

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INTRODUCTION

On December 23, 1975 President Ford signed the "Metric Conversion Act of 1975." Section 3 of this Act states, "It is therefore declared that the policy of the United States shall be to coordinate and plan the increasing use of the metric system in the United States and to establish a United States Metric Board to coordinate the voluntary conversion to the metric system." The United States is finally moving into the metric world. It is almost a certainty that students now in elementary school will graduate into a metric world. Our schools must begin preparing students for that world.

A *Policy Statement on Metric Education* was sent to all schools in New York State in January 1975 proposing "a carefully planned and coordinated change-over to metrics in the instructional program of the schools of the State." This bulletin has been prepared to provide schools with some ideas for introducing metrics into their programs. General ideas for getting started are included and suggested activities are listed for various subject areas. Metric education must be approached from an interdisciplinary viewpoint wherever measurement is used.

This publication was prepared by LeRoy Negus, Chairman, Department Metric Committee, with input from each of the subject area bureaus. Some of the ideas were taken from materials developed by David Dye, Mathematics Consultant, State of Minnesota and Susanne Reeder, Mathematics Supervisor, City of Buffalo.

IDEAS FOR INTRODUCING THE METRIC SYSTEM

SUGGESTED METRIC IMPLEMENTATION TIMELINE FOR ALL SCHOOLS IN NEW YORK STATE

During 1976-77	Appointment of Metric Coordinator • establish a metric committee • acquisition of workshop materials • accumulation of software resources • teacher awareness workshops • public awareness workshops • flow chart of introduction
By January 1978	Inventory of equipment by all departments • set purchase plan for software, small tools, and major equipment • teacher orientation classes • survey of texts and references for possible metric supplementation
By June 1978	Inservice workshops by grade level and departments • preparation of teaching materials • rewriting of worksheets and project plans, science/math experiences, physical education/sports instruction • administrative survey of support needs: i.e., nurse, health, bus service, and purchasing practices • book orders include metric
By June 1979	Substantial substitution of metric for customary in-classroom work at all levels • use in references and project plans • parent workshops
By June 1980	Metric year • use of metric in all grades and subjects • customary measurement a minor part of measurement education • metric the predominant measurement system

Any school system that decides to begin metric instruction needs to plan carefully. Consider five phases that the community must go through in changing to metrics.

Phase I - Awareness

The public must become aware of the metric system, the reasons for adoption, and the time schedule for adoption. Announcements, conferences, publicity in newspapers, magazines, and on radio and TV, interdisciplinary and agency discussion all have a part.

Phase II - Knowledge (Information gathering)

"Think Metric" in common usage. The *meter*, *liter*, and *gram* with prefixes milli, centi, deci, and kilo. Celsius temperatures.

Phase III - Comprehension

Metric computation workshops, inservice courses, teacher training, parent-teacher meetings, school board workshops, media campaigns.

Phase IV - Application

Metric textbooks, references, measurements, labeling, purchasing, publications, communications, signs, charts.

Phase V - Commitment (Adoption)

Full metric terminology, practice, and standards in all purchasing, publications, references, and specifications.

In our present society we probably cannot do more than to get into *Phase IV* but we should get started. Following are some suggested steps for getting started:

(1) Establish a metric committee with school board members, administrators, teachers, and lay people.

(2) All classrooms should have metric measuring devices - metric tapes or rules, Celsius thermometer, etc.

(3) Encourage a local merchant to sell meter sticks, metric tapes, Celsius thermometers, kitchen measuring utensils, and metric bathroom scales.

(4) Provide adult education courses.

(5) Distribute metric handouts such as the National Education Association leaflet, "Think Metric" or the National Bureau of Standards sheet, "All You Will Need To Know About Metric."

(6) Develop and implement an inservice program for teachers. From 8 to 15 hours is enough for learning the metric system and for learning tactics for teaching it to children.

(7) Be careful of commercial materials - Don't stress conversions from customary to metric. Measurement should be done completely within the metric system.

(8) Consider a Metric Day or a Metric Week for the school when all classes will stress metric measurement.

(9) Encourage a "Think Metric" approach throughout the school system.

(10) Set up a metric poster contest. There might be categories, such as primary, intermediate, junior high, and senior high. Prizes might be donated by local merchants.

(11) Provide articles on the metric system to the local newspaper throughout the year.

GUIDELINES FOR CHOOSING METRIC CURRICULUM MATERIALS

(1) BE SELECTIVE - DON'T OVERBUY! Some of the best devices are teacher-made from inexpensive materials.

(2) The material should be ACCURATE AND SHOULD USE THE NOTATION AND TERMINOLOGY OF SI (International System of Units). Exceptions: (a) Either spelling "meter" or "metre" and "liter" or "litre" is acceptable. Students should be taught to recognize both. (b) Although "mass" is technically preferable when using grams and is best if teachers are comfortable using it, "weight" will probably be used in everyday life by most people.

(3) Materials should TEACH STUDENTS TO "THINK METRIC" - not convert measurements from metric to customary.

(4) Materials should stress an ACTIVITY-ORIENTED APPROACH - not a workbook or paper and pencil approach.

(5) Materials should BE EASY TO USE with teacher's manuals where necessary.

(6) The complexity of the materials SHOULD FIT THE GRADE LEVEL where they will be used.

(7) Materials should STRESS THE DECIMAL nature of the metric system.

SUGGESTED GUIDELINES FOR TEACHING THE METRIC SYSTEM IN THE ELEMENTARY SCHOOL

(1) General measurement activities with nonstandard measures should precede the development of the metric system. Students need to see that any arbitrary standard may be used to measure.

(2) The logic of the metric system with its "tenness" should be developed.

(3) Provide for a variety of measurement activities using metric measurement devices. Start with linear measure and then bring in area, volume (capacity), and mass. Temperature may be brought in at any time.

(4) Do not stress conversion from metric to customary or customary to metric. Treat them as dual systems. Students may relate the two systems by such comparisons as:

A meter is a little longer than a yard.
A liter is a little larger than a quart.
A kilogram is a little over two pounds.

Think metric!

(5) Introduce the metric units and prefixes as they are used. Do not require the students to memorize a table at the beginning of the year. In the elementary school the prefixes milli, centi, deci, and kilo are the ones most used.

(6) Estimation should be a part of every measuring activity. Think metric.

(7) Every teacher should have a copy of the Department's pamphlet, "Let's Use the Metric System."

(8) Use metric units at every opportunity in as many subject areas as possible. A "Metric Day" or a "metric Week" may be useful for creating interest.

(9) As in many other activities, set up an educational and public relations program to get the board and community working with you.

SOME METRIC ACTIVITIES FOR THE ELEMENTARY SCHOOL

(1) Have students do the majority of their measuring activities using metric tools. A measurement kit might be provided for each student. An envelope with 10 straws - each 1 centimeter long, two straws - each 1 decimeter long, and a string 1 meter in length.

(2) At the grocery store, make a list of five items that have both metric and customary weights or volumes, showing both measurements.

(3) Hold a track meet using the metric distances for the events.

(4) Give a school weather report and forecast using the metric values.

(5) Find signs and posters outside of school that will have to be changed when we go metric. Design the new signs and posters.

(6) Go through magazines and newspapers. Find articles and ads in which the metric system is used.

(7) Using a State road map, make a table showing the metric distances from the school to cities around the State.

(8) Use bulletin boards and displays involving metric measure.

(9) Measure distances from classroom to principal's office, cafeteria, gym, etc. in meters and place signs prominently in hall.

(10) See the booklet "Let's Use the Metric System" for other ideas for the elementary grades.

METRIC ACTIVITIES FOR THE SECONDARY SCHOOL (ALSO ELEMENTARY)

Agriculture Education

(1) Have students discuss the ramifications of the change to the metric system for farmers and agri-business.

(2) Have students look for present uses of the metric system on the farm and in the home.

(3) Investigate the unit of land area called the hectare. Compare this with acres.

Art Education

(1) Devise graphics which can be used to enlighten and educate the public about the metric system.

(2) Cooperate with other departments in preparing posters for a "Think Metric" drive.

Business Education

(1) Discuss how businesses and offices will be affected with the change to the metric system. Will office personnel need to know the system well? Explain.

(2) Secretaries, typists, and office machine operators will have to know the correct abbreviations, paper dimensions, and new scales used on typewriters and other office machines.

(3) Bookkeepers and other record keepers will have to become familiar with terminology and relationships of the metric values to perform various types of office computation, record keeping, and billing.

Driver Education

(1) Plan a trip using a New York State road map, and translate distances into kilometers.

(2) Discuss kilometers per liter as an alternate to miles per gallon.

(3) Drive over a measured kilometer and compare with a mile.

(4) Convert present speed limits to metric. What problems will arise when we change to metric? Discuss.

English Language Arts

(1) Have students prepare an advertising campaign to convince people to use the metric system.

(2) Ask students to select ads from magazines and newspapers. Convert the information in the ads to the metric system.

(3) Hide a "treasure." Draw a map, or give directions, using metric measurements. Have the students find the "treasure."

(4) Using Poe's "The Gold Bug," have the students convert the directions to the metric system.

(5) Have the students write a short story in which metric measurement plays an important role.

Foreign Languages

(1) Discuss and compare the measurement system of the country(ies) whose language(s) is being studied.

(2) Learn the derivation of the base units and prefixes. Show similarities of nomenclature in all languages.

(3) Have students create posters and bulletin board displays featuring the metric system with all terminology and numbers in the target language.

(4) Through a geography unit based on an extensive trip through countries being studied, determine the number of kilometers between featured cities and landmarks, density of population per square kilometer, and how many liters of gasoline will be consumed by a foreign compact car whose engine characteristics could also be described in metric terms. Point out that gasoline consumption in most European countries is computed in liters per 100 kilometers and horsepower is determined on a different basis.

(5) Through a unit based on a shopping trip to specialty stores and the local market in a foreign town, purchase foodstuffs using kilograms and liters.

(6) Through a unit featuring the preparation of a foreign food specialty, use metric measurements for ingredients (dry and liquid) and for baking or cooking temperatures.

(7) Discuss the climate and weather in the target language areas using degrees Celsius for temperatures, in various seasons, millimeters for average precipitation, and kilometers per hour for wind velocity.

(8) Point out metric nature of all foreign currencies (recent change in British system).

(9) Using the international system of square meters to determine the amount of living space in a dwelling, measure your home and compare with the average space of a dwelling in the country of the target language. (If applicable, measure your property and compare with corresponding property in the target language country. For example, farms, suburban housing, apartments, etc.)

Health Education

(1) Measure the height and weight of students using the metric system.

(2) Use metric measures when studying units on nutrition.

(3) Investigate current reports regarding the effects of freon gas contained in aerosal sprays on human health.

(4) Using the metric system, construct a graphic presentation to demonstrate the degree to which the earth's atmosphere has already been altered, and will be altered within the next 10 years. Relate the amount of gas released to the extent to which the atmosphere is changed, the subsequent increase in radiation received by the earth, and resulting increases in the incidence of health problems (e.g., cancer of the skin).

(5) Have students investigate what sources of water are used for the requirements of industry, and of homes, in their community. Have them calculate how much water, in liters, is used by each per day, from each source, and for what purpose. Students might record how much water they personally use in a 24-hour period.

(6) Make a chart showing the comparative volumes of safe and unsafe water available for use in the United States, and in another country, such as India. Show figures regarding water available per person in each country. Express findings in liters.

(7) Utilize the metric system when discussing the pharmacological aspects of drugs, alcohol, and tobacco.

(8) Utilize the metric system when discussing causes and prevention of accidents (first aid and safety course).

(9) Utilize the metric system when teaching a unit on consumerism.

(10) The metric system should be used for nearly every health topic in regards to the incidence of disease, epidemiologic studies, surveys, and the like.

Homemaking - Family Living

(1) Plan a project for a group of students to help them "Think Metric."

(2) Develop a bulletin board or display on the effect of the metric system on the home.

(3) Obtain and use metric tapes, charts, measuring cups, and recipes.

(4) Write a recipe using metric measures. There will be changes in measurements of ingredients, pan sizes, and oven temperatures.

(5) Use metric recipes when cooking; include some recipes from foreign cookbooks.

(6) Determine your chest, waist, hip, and height measurements in metric.

(7) Use a pattern with metric measurements for constructing a garment.

(8) Figure the area of a floor metrically. How many 30 centimeter tiles are needed to cover the floor of your classroom?

(9) Develop and use a conversion table for changing some recipes from customary to metric for practice. A conversion table will also be necessary when using metric recipes with customary pans and oven settings.

(10) Compute fabric requirements for draperies, slip covers, and an articles of clothing in metric amounts.

(11) Research how clothing is sized in some of the countries already involved in metric measurements.

(12) Investigate point-of-sale aids and guides that would help consumers make informed choices when metric units become predominant in stores.

(13) Conduct a supermarket survey to find out: what products have labels in metric units, dual-labeled, or unlabeled and what value metric labeling is to the average consumer at this time.

(14) Investigate and report on the status of legislation for metric conversion and what stands consumer groups are taking on such legislation.

(15) Organize and prepare a meal using only metric measures.

Industrial Arts

(1) Discuss with the students the implications of a changeover to the metric system as applied to their particular vocations.

(2) Design an article with metric dimensions and make it using metric measures.

Library Media

(1) Find information on the metric system. Where did you look first? What did you find? Where did you look second? What did you find?

(2) Find evidence of the use of metric measurement in our country at the present time. Verify this by talking to druggists, doctors, camera salesmen, etc.

(3) Develop a bibliography of multimedia resources available in the library.

(4) Develop multimedia resource kits for various grade levels and/or focusing on various subject areas.

(5) Have high school students develop multimedia presentations on various aspects of metrication for presentation to elementary pupils.

(6) Develop reference and research skills lessons based on metrication themes or activities suggested for the various subject areas.

(7) Create a floor plan of the library media center using metric measure.

(8) Create displays, exhibits, and bulletin boards publicizing available resources.

Mathematics

(1) Provide a metric unit for the junior high school classes. A review unit may be necessary for the senior high classes.

(2) Prepare problems using metric measures.

(3) Do some outside field work using metric measures.

(4) Do some work on computing areas and volumes in the metric system. Compare the ease of this with the use of customary units.

(5) Assign students optional enrichment work such as:

- Report on the history of the metric system.
- Develop a metric time system.
- Develop a metric angular measurement system including trigonometric functions of the newly defined angle sizes.

Music

(1) Discuss the statement: Music is a universal language and, as such, transcends any changes within the various languages or systems of weights and measures.

(2) Gooperate with other departments, particularly math, social studies, and language arts in discovering songs about the metric system which might be sung, and encourage children to create and perform their own songs which relate to concepts about the metric system.

Physical Education

(1) Disouss measurement changes to the metric system in such things as tennis, golf, and other sports. Some students may want to find out how playing fields, courts, etc. are laid out in metric countries.

(2) Discuss how sports records may be changed when we adopt the metric system.

(3) Hold a track meet and use the metric system for identifying distances, heights, and weights.

(4) Discuss the effects of a measurement change to the metric system in sports supplies and equipment; i.e., length of baseball bat; circumference of baseball, basketball, volleyball, etc.; weight of shot putt, discus, weight lifting equipment; length of skis!!

Science

(1) Since metric measure should be used almost exclusively in the science classes. Discuss how metrics can be brought more into society.

(2) At the appropriate level, discuss the relationships between length, volume, and mass in the metric system.

(3) Find out about, and discuss the differences between the old metric system and the S.I.

(4) Have high school students develop simple experiments involving metric measure for elementary classes.

Social Studies

(1) Discuss: Why should we change to the metric system? Give five advantages, five disadvantages.

(2) Predict attitudes toward change to the metric system as related to age. Survey to check the prediction.

(3) Develop a list of countries not now committed to the metric system. What does this finding imply to us? What about countries that we trade with?

(4) Identify occupations now using the metric system. Find out why they use the system.

(5) Identify those occupations which will have to undergo the most change when converting to metrics.

(6) Interview parents on how the metric system will affect them.

(7) Interview the custodian and the secretary to identify changes for them when the metric system is adopted.

(8) Plan a trip using the metric system. (gasoline, distance, rate, etc.)

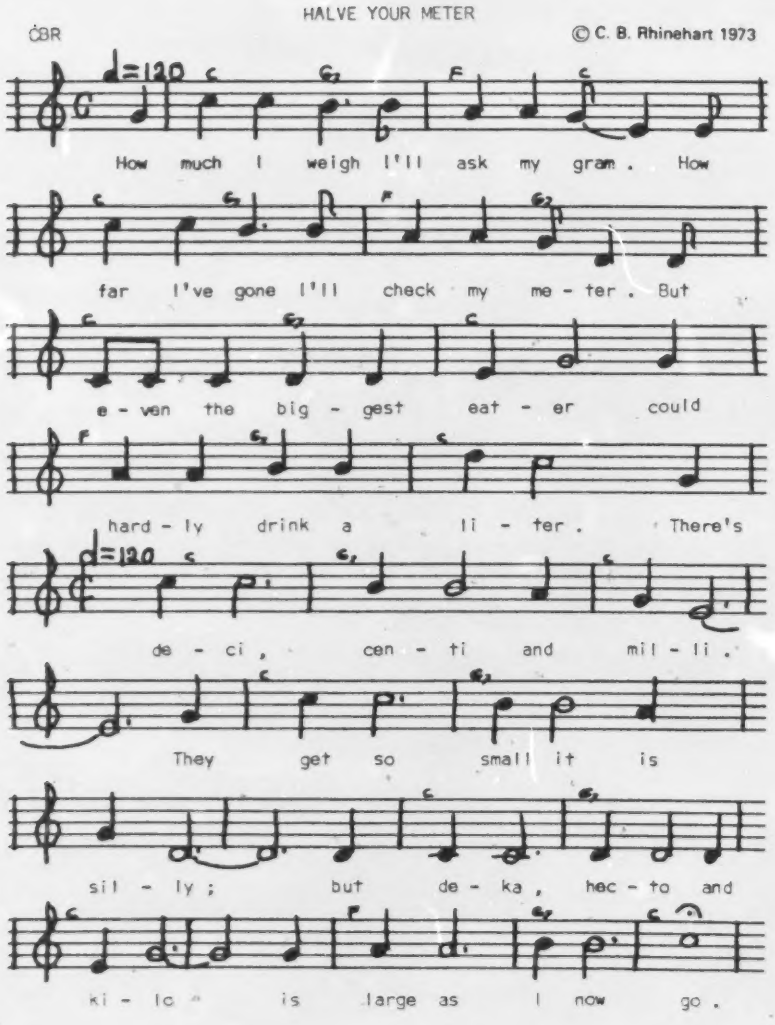
(9) Role play a radio-television personality announcing a sporting event using the metric system.

(10) Think of some ways that unethical businessmen can use the metric system in dishonest transactions.

(11) Think of some ways that ethical businessmen can use the metric system to benefit the public.

(12) Write a letter to your Congressman suggesting ways to ease the problems of change.

(13) Discuss how a common measurement system would contribute to better world communication and understanding.

Halve Your Meter

HALVE YOUR METER
CBR
© C. B. Rhinehart 1973
How much I weigh I'll ask my gram . How
far I've gone I'll check my me - ter . But
e - ven the big - gest eat - er could
hard - ly drink a li - ter . There's
de - ci , cen - ti and mil - li .
They get so small it is
sil - ly ; but de - ka , hec - to and
ki - lo is large as I now go .

Charles B. Rhinehart
Oswego Campus School

HIDDEN METRICS

Can you find all thirteen hidden words pertaining to the metric system?

A	C	I	H	Q	W	E	H	D	G	P	V	O	E
F	L	E	K	I	L	O	M	E	T	E	R	D	N
X	E	Q	J	D	G	D	F	C	S	S	M	U	F
K	A	M	P	E	R	E	R	I	L	R	T	T	K
P	J	I	O	D	E	K	A	L	I	T	E	R	I
D	M	Y	N	C	Z	A	B	I	U	C	A	W	L
R	C	E	N	T	I	M	E	T	E	R	V	R	C
B	Y	M	L	A	X	E	S	E	I	G	E	K	G
K	N	S	K	L	I	T	E	R	H	T	J	L	R
Q	P	E	Z	W	J	E	U	T	E	G	A	H	A
H	E	C	T	O	G	R	A	M	E	A	M	B	M
S	O	O	X	V	P	F	O	A	D	I	B	A	C
T	Y	N	R	G	Y	E	N	S	D	K	R	C	I
Z	V	D	U	Z	L	W	X	S	F	G	H	G	J

Buffalo City Schools

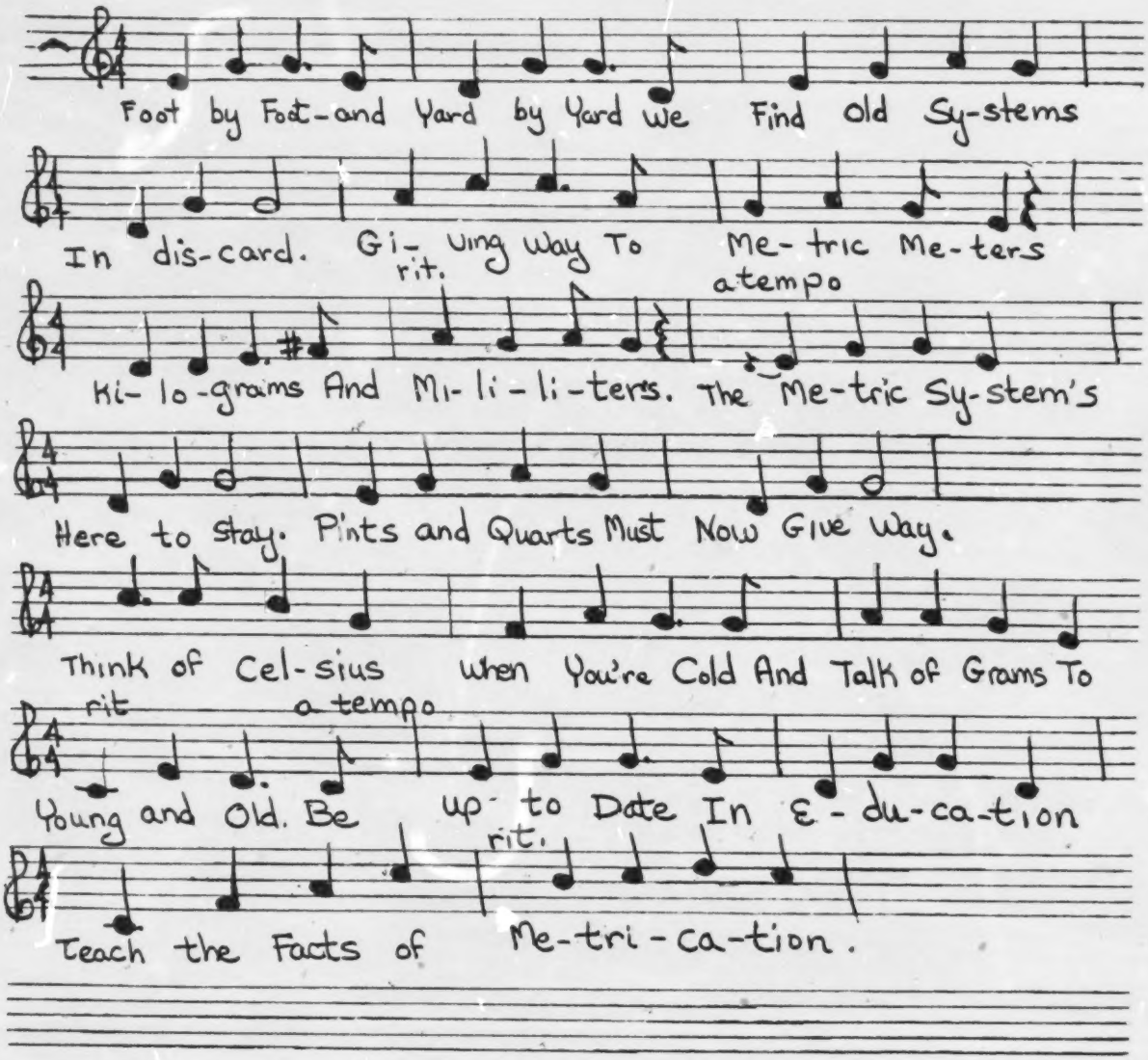
Find the following hidden words.

metric	celsius	decimeter	length	volume
meter	second	dekagram	mass	kiloare
liter	are	microsecond	time	milligram
ampere	gram	kiloliter	degree	hectogram
candela				

H	K	Z	A	F	J	R	B	G	Q	L	I	T	E	R	A	E	L	K	P
A	D	E	K	A	G	R	A	M	F	S	P	J	F	L	K	Q	I	D	K
F	X	M	E	E	T	S	C	I	P	R	I	E	V	M	F	D	J	O	M
Y	Z	G	E	L	D	R	B	L	E	Q	O	S	M	O	N	J	L	C	H
B	D	W	X	T	C	T	H	L	U	D	K	I	L	O	L	I	T	E	R
I	E	T	D	H	R	Q	C	I	N	N	O	M	C	G	N	U	I	H	X
N	C	M	Y	D	M	I	V	G	L	U	G	E	N	G	O	B	M	I	P
A	I	C	L	B	U	K	C	R	J	T	S	K	P	V	B	W	T	E	A
M	M	V	U	W	R	K	O	A	N	O	O	V	I	E	U	I	C	Y	H
W	E	G	S	T	A	C	F	M	R	S	W	A	Q	L	D	C	S	R	B
I	T	T	U	V	D	T	P	C	E	L	S	I	U	S	O	R	Y	X	E
V	E	W	E	X	R	Q	I	R	Q	Y	B	J	Z	E	F	A	J	E	G
L	R	J	Y	R	E	M	V	M	A	L	P	O	K	C	D	Q	R	O	I
J	X	H	I	X	M	W	K	S	E	P	N	L	E	O	Z	G	H	E	F
Y	K	G	K	E	Z	L	U	R	H	M	A	I	F	N	E	G	D	Q	T
Z	J	E	R	Y	G	N	E	T	U	M	Q	G	N	D	R	B	Z	E	U
F	X	A	D	A	O	P	V	N	P	Z	A	F	H	Y	S	C	G	T	J
W	L	H	Z	O	M	A	S	S	G	B	P	C	A	N	D	E	L	A	O
M	I	M	R	A	P	Q	C	R	S	T	E	Z	Y	D	C	S	W	X	V
V	A	U	N	T	B	W	L	N	X	K	H	E	C	T	O	G	R	A	M

ODE TO THE METRIC SYSTEM

words J. March
music D. Glaser


Foot by Foot-and Yard by Yard we Find old Sy-stems
In dis-card. Gi- ving Way To Me-tric Me-ters
rit.
a tempo
Ki- lo-grams And Mi-li-li-ters. The Me-tric Sy-stem's
Here to Stay. Pints and Quarts Must Now Give Way.
Think of Cel-sius when You're Cold And Talk of Grams To
rit
a tempo
Young and Old. Be up to Date In E-du-ca-tion
rit.
Teach the Facts of Me-tri-ca-tion.

METRIC RECIPES

Chocolate Pudding (by volume and mass)

85 grams semisweet chocolate pieces
60 grams sugar
40 grams cornstarch
700 milliliters milk
25 grams margarine
5 milliliters vanilla

Chocolate Pudding (by volume)

120 milliliters semisweet chocolate pieces
75 milliliters sugar
50 milliliters cornstarch
700 milliliters milk
30 milliliters margarine
5 milliliters vanilla

In a heavy 2-liter saucepan, stir together chocolate pieces, sugar, and cornstarch. Gradually stir in milk. Cook over medium heat, stirring constantly, until mixture comes to a boil and boils 1 minute. Remove from heat. Stir in margarine and vanilla. Pour into six small custard cups. To prevent film from forming on top of pudding, place a plastic wrap directly on top of pudding. Chill in refrigerator. Makes six servings.

Graham Muffins (by volume and mass)

165 grams graham cracker crumbs
7 grams baking powder
1 large egg
125 milliliters milk
75 milliliters corn oil
50 milliliters dark corn syrup
55 grams chopped pecans

Graham Muffins (by volume)

375 milliliters graham cracker crumbs
10 milliliters baking powder
1 large egg
125 milliliters milk
75 milliliters corn oil
50 milliliters dark corn syrup
125 milliliters chopped pecans

Grease 12 (6.4 x 3.2 centimeters) muffin cups. Set oven at 190°C. In mixing bowl, stir together with fork cracker crumbs and baking powder. In another bowl, beat egg with fork until frothy. Add milk, corn oil, and corn syrup; stir to mix well. Add to graham cracker crumbs all at once. Stir until mixed but still lumpy. Gently stir in nuts. Spoon into muffin cups, filling each cup two-thirds full. Bake in preheated oven 20 minutes or until wire inserted in center of muffin comes out clean. Run spatula around each muffin to loosen. Serve warm in napkin-lined basket. Makes 12 muffins.